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PRBO Conservation Science



Photos by Peter LaFollette and PRBO

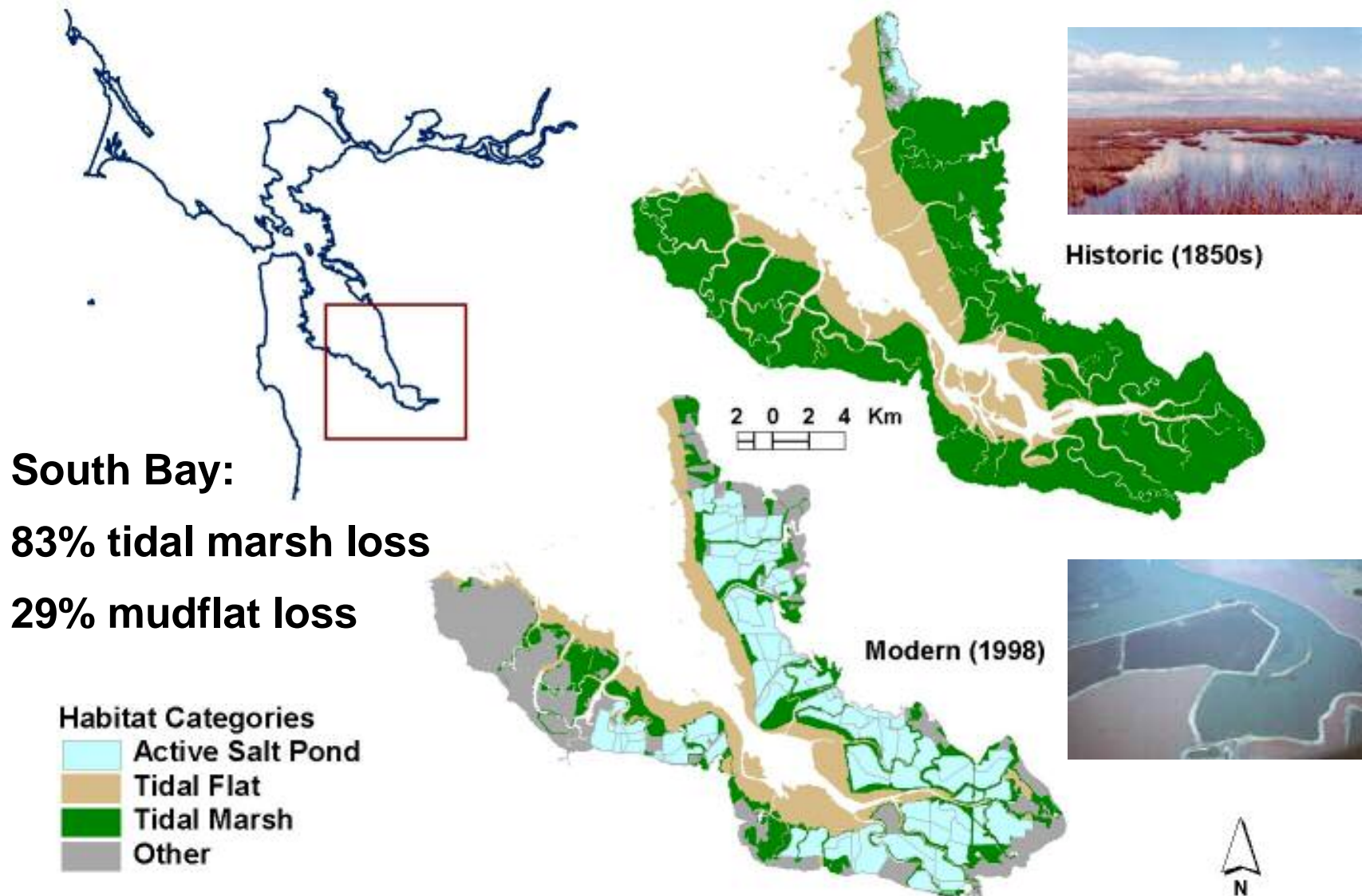
Diana Stralberg, Mark Herzog, Nils Warnock, Nadav Nur

San Francisco Bay Estuary

- **Designated site of hemispheric importance for shorebirds**
- **Important waterfowl wintering area**
- **Largest area of tidal marsh habitat on west coast for breeding songbirds and rails**
- **South SF Bay waterbird use particularly high**

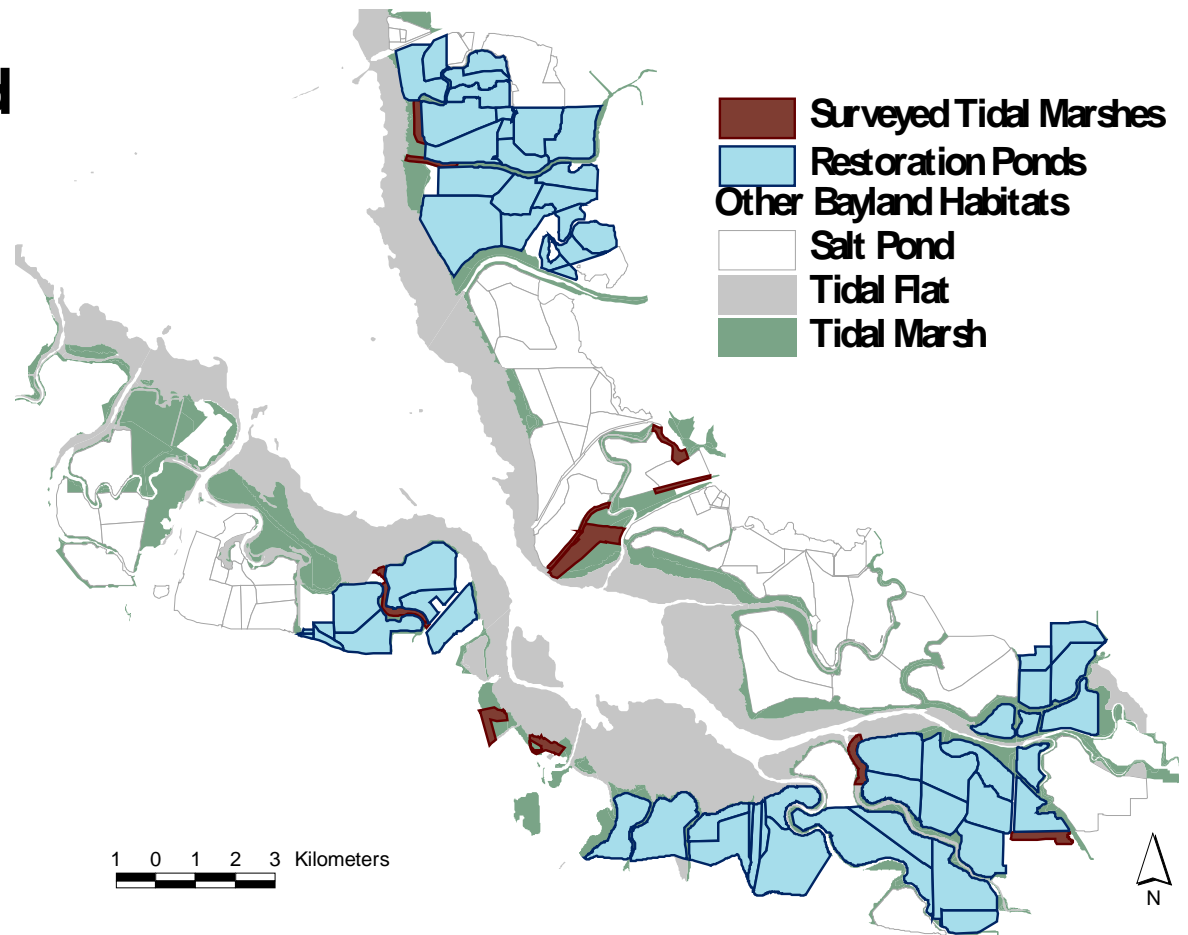


Historic Habitat Change: Diking, Filling, Dredging



Current Habitat Change: Salt Pond Restoration

- 5,471 ha of salt ponds purchased by state and federal agencies for restoration to tidal and managed marsh
- California Coastal Conservancy overseeing restoration



Salt Pond

Tidal Marsh

Restoration Trade-offs



Least Sandpiper



Western Grebe



Northern Shoveler



American Avocet



Northern Pintail



Northern Harrier



Willet



Salt Marsh
Common Yellowthroat



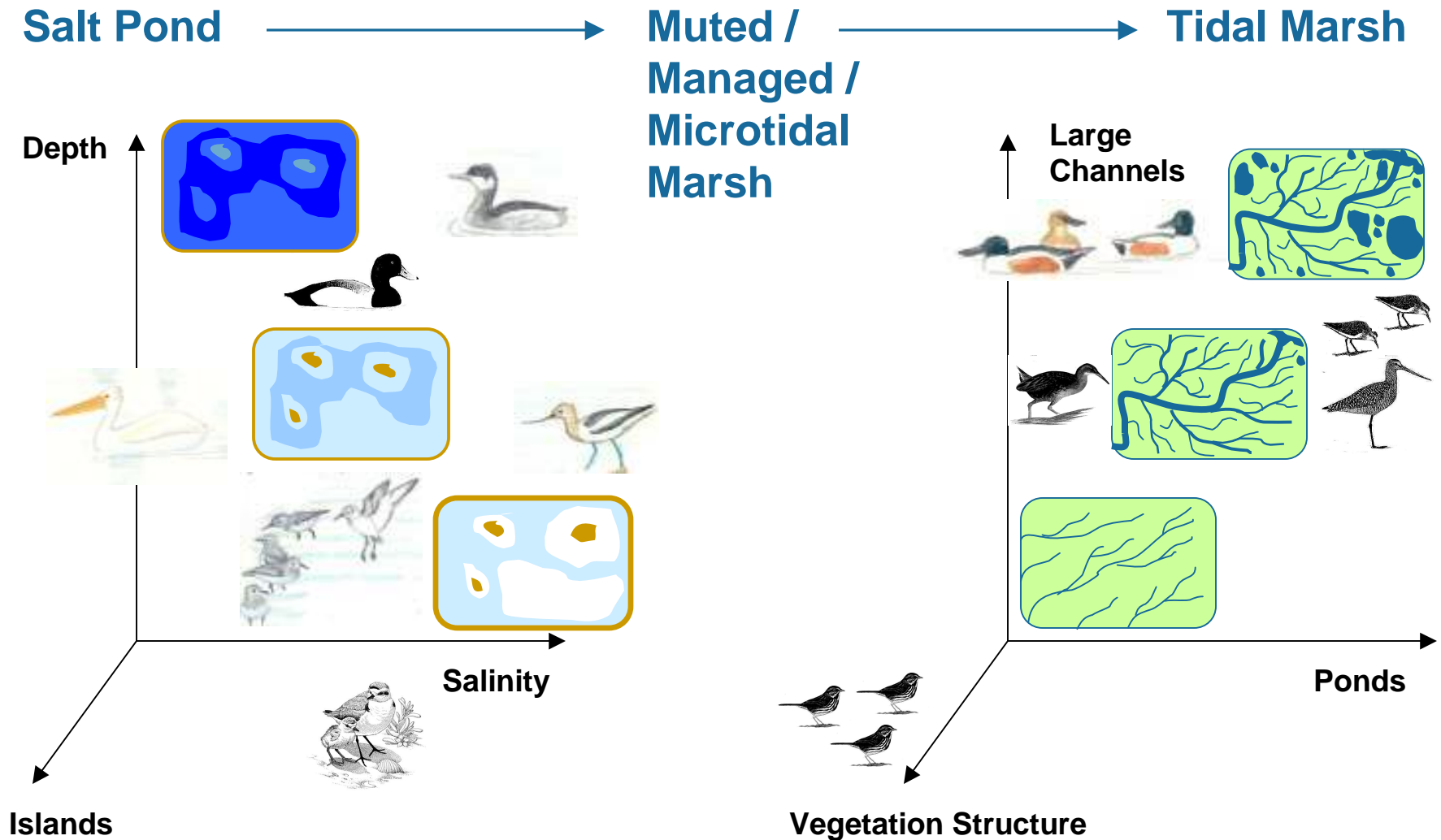
Alameda
Song Sparrow



California Clapper Rail

Bird Photos ©
Peter
LaTourrette

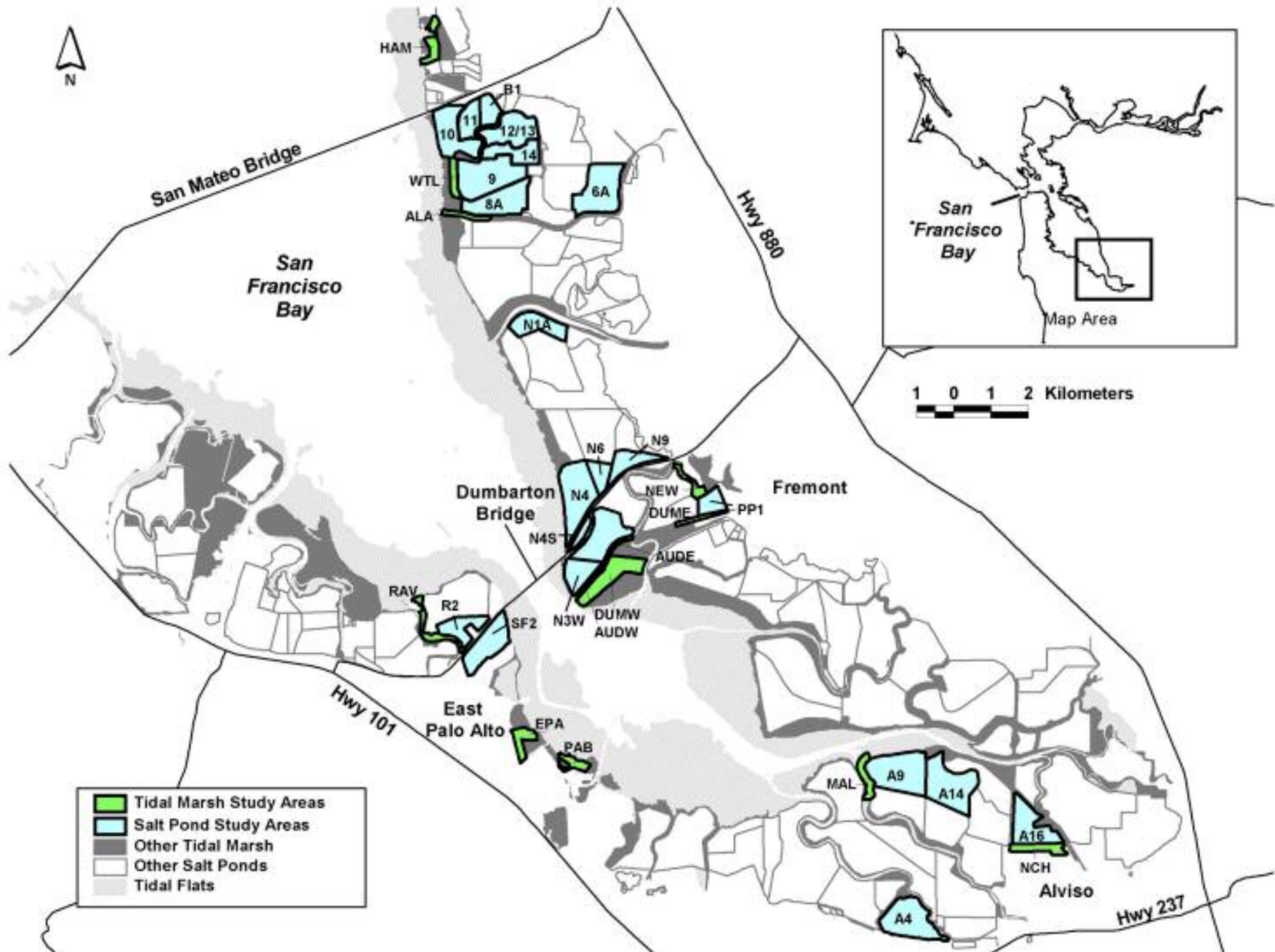
Range of Possible Habitats



Model Objectives

- **Identify bird-related costs & benefits of converting salt ponds to tidal marsh**
- **Develop quantitative ability to help guide:**
 - **Design of tidal marsh restoration projects**
 - **Management of remaining salt ponds**
 - **Optimal configuration of tidal marshes and salt ponds**

Study Areas



Survey Methods



- **Salt Pond / Tidal Marsh Area Surveys**
October – April,
1999-2001
Paired High / Low Tide



- **Tidal Marsh Point Count Surveys**
October – April,
1999-2001

Site Characteristics



Salt Ponds

- Salinity (ppt)
- Pond size

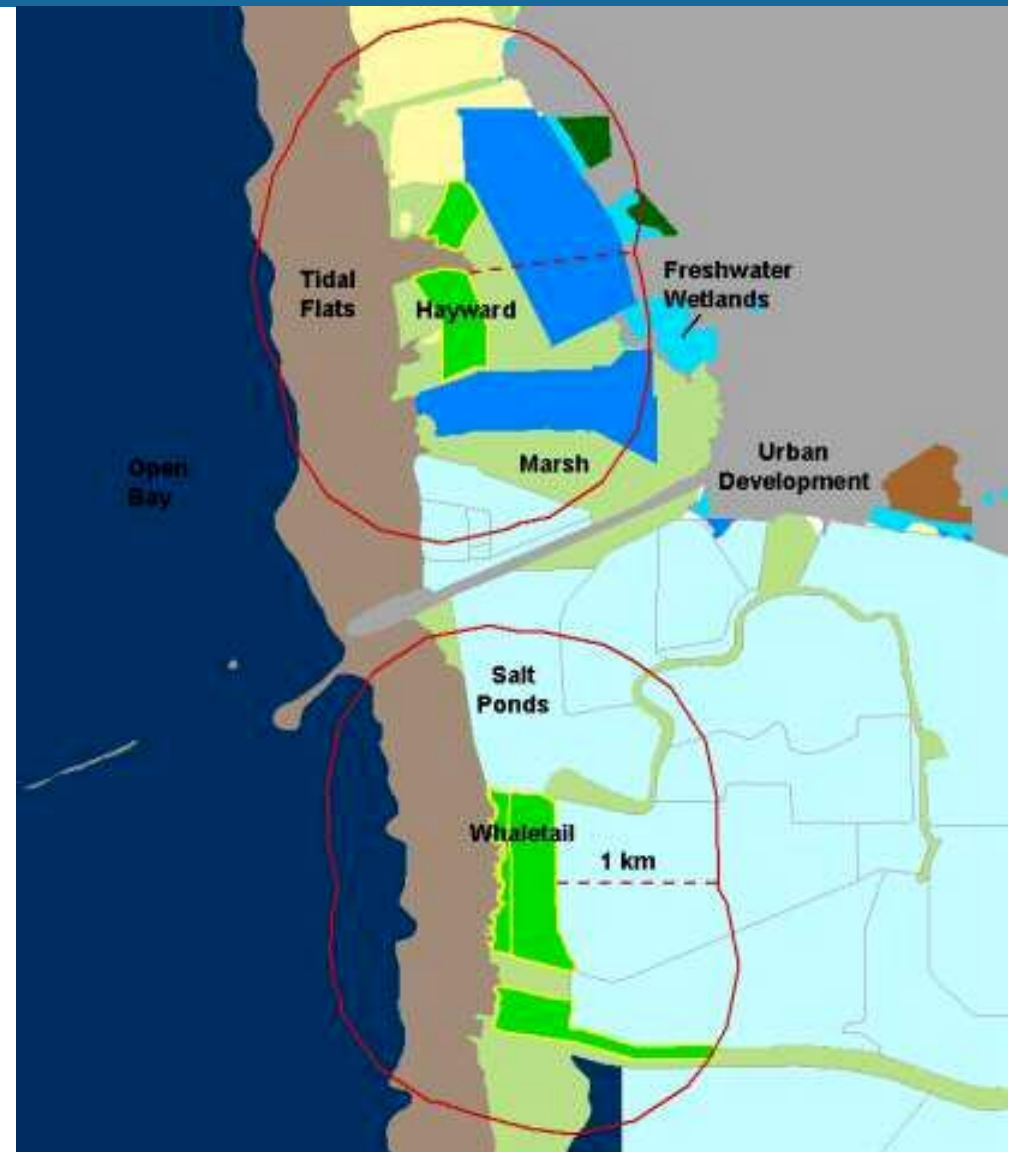


Tidal Marsh

- Channel density by width class
- Poned area

Landscape Characteristics

- Distance to open bay, development
- Surrounding landscape composition



Tidal Marsh Model Parameters*

	Songbirds and Rails	Small Shorebirds	Large Shorebirds	Dabbling Ducks	Diving Ducks
<i>Site Characteristics</i>					
Large Channel (> 8 m) Area			+	+	+
Ponded Area	-	+	+	+	
<i>Landscape Characteristics</i>					
Salt Ponds within 1 km	-				
Mudflat within 1 km		+		+	
Marsh within 1 km	+				
Open Bay within 1 km					+

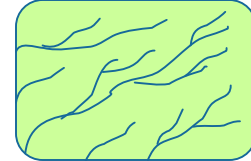
* Signs of coefficients from multiple regression models (bird variables log-transformed)

Site-level Restoration Scenarios*

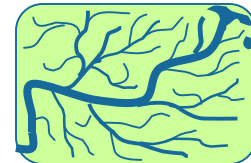
1 - Salt ponds retained at current salinities (no change)

All salt ponds restored to tidal marsh:

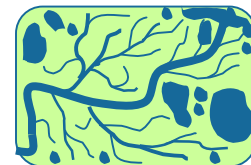
2: minimum large channels and ponded areas



3: mean large channels and ponded areas

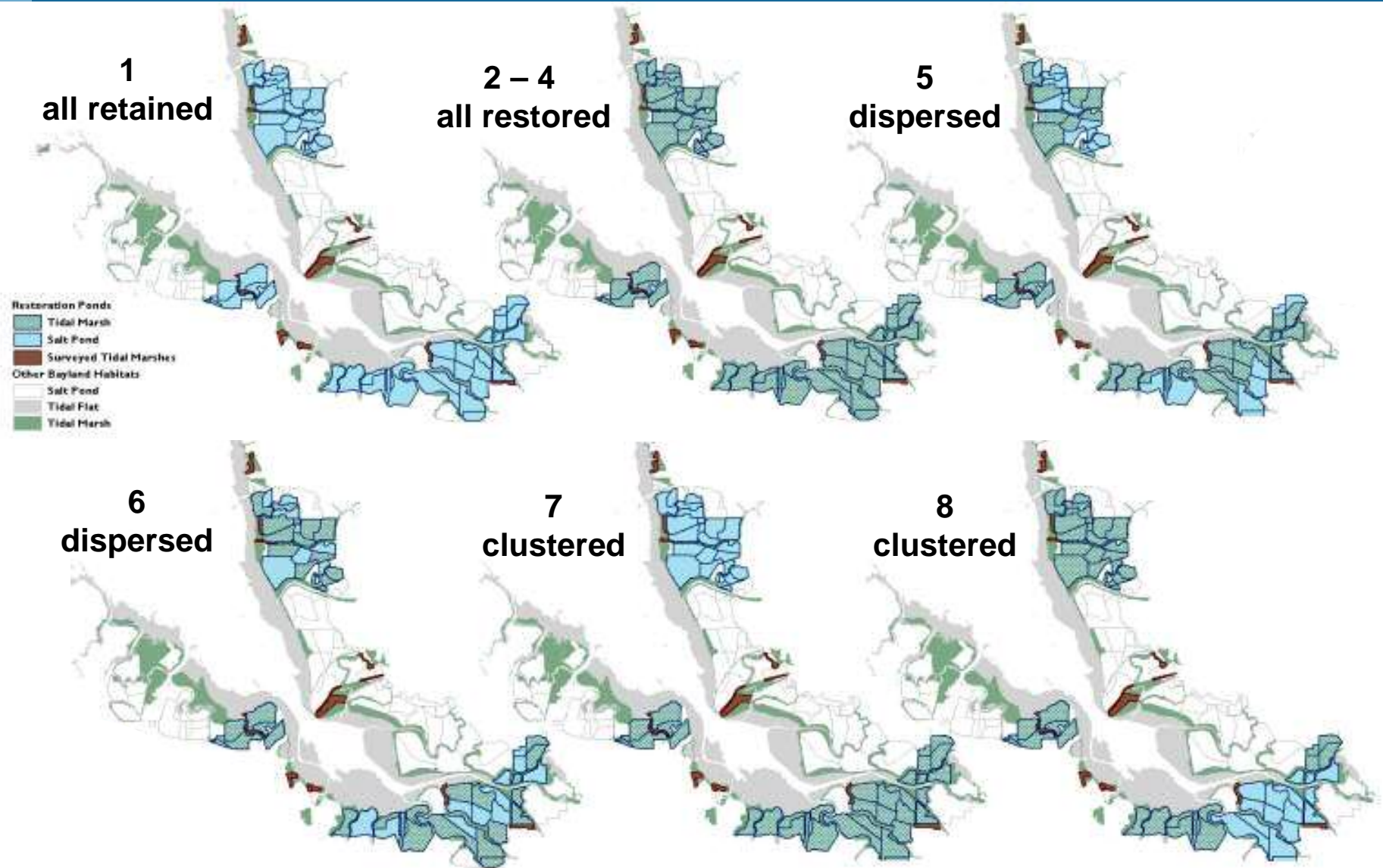


4: maximum large channels and ponded areas

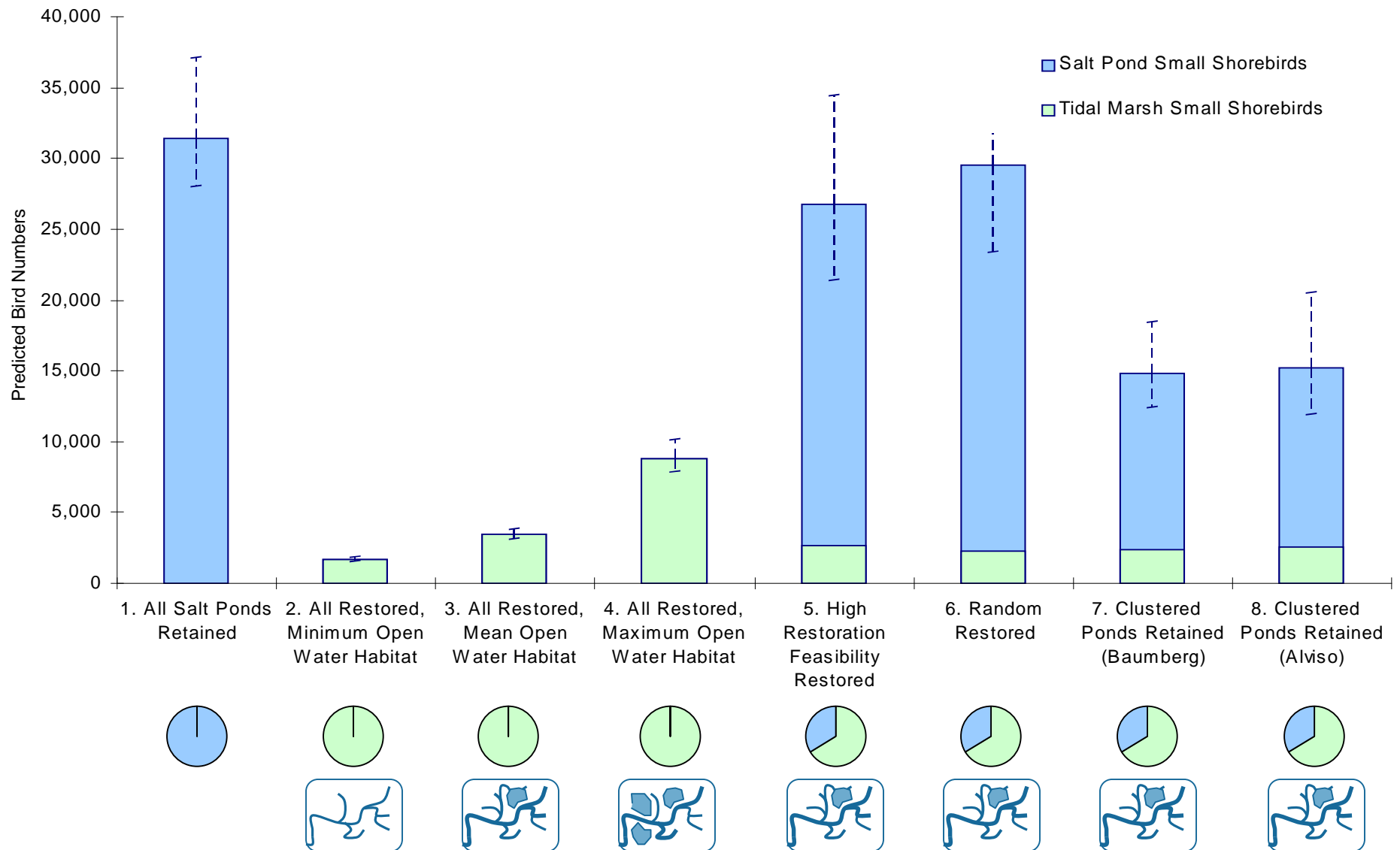


* Landscape conditions incorporated into models.

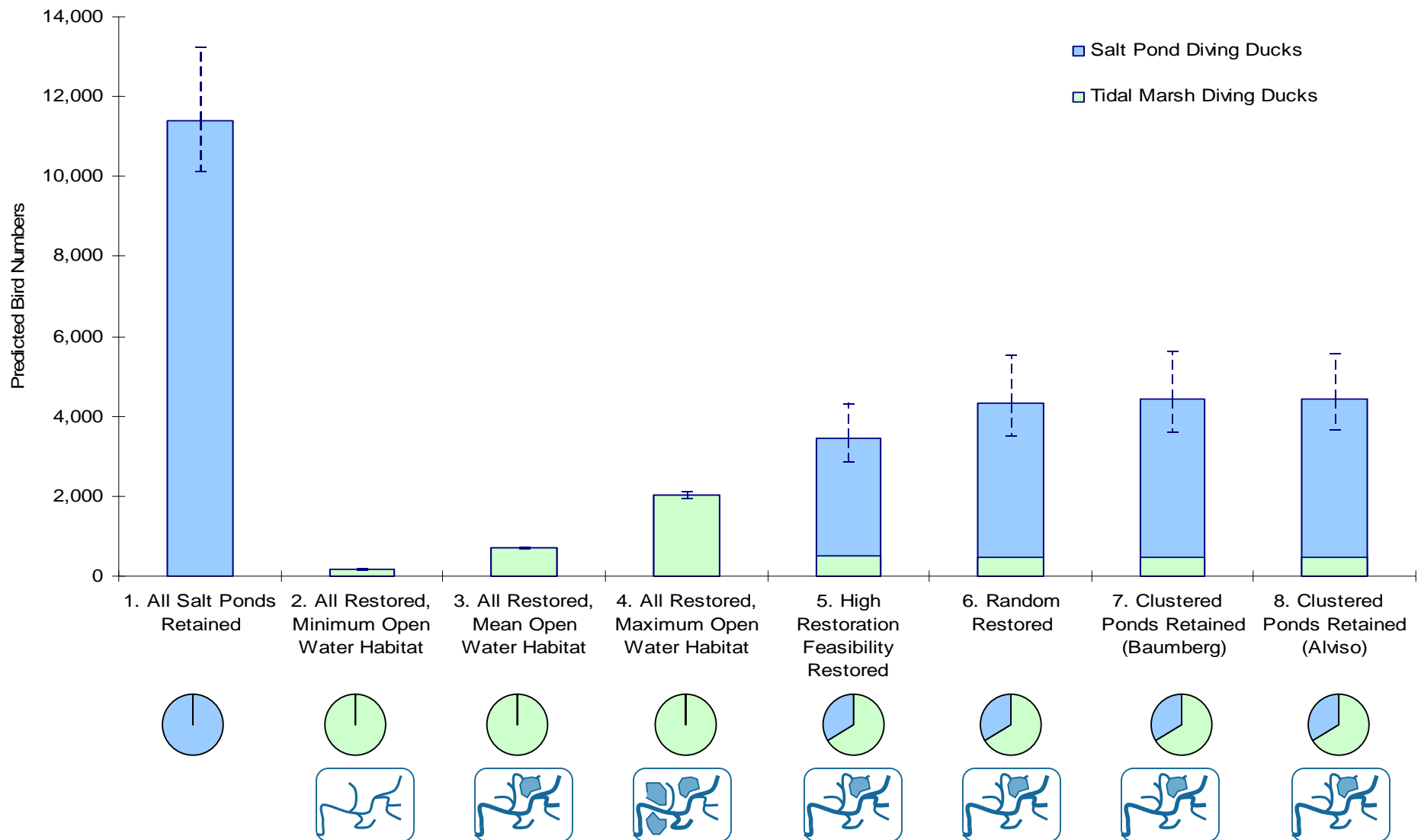
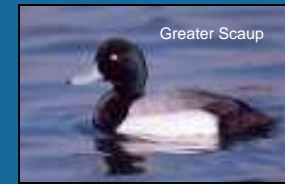
Comparing Restoration Scenarios



Scenario Comparisons, Small Shorebirds



Scenario Comparisons, Diving Ducks



Conclusions from Phase I

- **Loss of salt ponds may cause substantial reduction in waterbird numbers, especially small shorebirds and diving ducks.**
- **Potential to reduce and/or avoid waterbird losses through design and management of individual restoration sites.**
- **Critical for waterbirds to retain some salt ponds in a habitat mosaic (more important than tidal marsh design and management).**

Recommendations from Phase I

- **A few well-managed salt ponds can go a long way for waterbirds.**
- **Trade-offs are inevitable – try to optimize, but can't treat all species equally.**
- **A diverse wetland mosaic (salt ponds, tidal marsh, mudflat) will provide the best chance for all birds.**
- **Restoration should proceed with caution; monitor results along the way.**

Acknowledgements

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(Don Edwards San Francisco Bay NWR)

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Future Monitoring and Research Needs

- **Long-term monitoring program**
 - document population trends and habitat requirements
 - inform adaptive management
- **Food resources**
 - Salton Sea (fish, invertebrates)
 - created habitats (invertebrates)
- **Disease and contaminants**
- **Important habitat features (e.g., nesting sites)**
- **Agricultural habitats**